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ABSTRACT

This curriculum guide provides materials for a metal trades technology course of study at the high school level. Its stated purpose is to help students acquire the trade knowledge necessary to function effectively in the shipfitting, welding, and piping trades. Contents include: a course description, a list of general objectives; lists of shipfitting course objectives for grades 10, 11, and 12; lists of general as well as course objectives for welding in grades 10, 11, and 12; a list of general objectives for burning; and a list of general objectives for grinding. A curriculum outline index follows for shipfitting, welding, burning, and grinding and competencies are listed. Curriculum content outlines are provided for shipfitting, welding, burning, and grinding. A bibliography lists nine resources. Student progress record forms complete the guide. (YLB)

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METAL TRADES TECHNOLOGY

CURRICULUM

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PREPARED FOR:

CONNECTICUT STATE DEPARTMENT OF EDUCATION
DIVISION OF VOCATIONAL, TECHNICAL AND ADULT EDUCATION
VOCATIONAL-TECHNICAL SCHOOL SYSTEM
MIDDLETOWN, CONNECTICUT

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COURSE DESCRIPTION

The Metal Trades Technology course will help the student acquire the trade knowledge necessary to effectively function in the shipfitting, welding and piping trades. Students will apply the trade knowledge to basic fabrication problems encountered by the steel and piping trades. Sophomores learn applicable trade procedures and practices, use of tools and materials, products and devices common to the trade. Juniors receive extensive work experience with a continuing theory program. Seniors are given advanced theory, cost estimation, materials listing, job requirement calculations and more sophisticated work experience.

GENERAL OBJECTIVES

The student will be able to:

1. acquire the trade knowledge necessary to effectively function in the shipfitting, welding and piping trades.
2. demonstrate the ability to apply trade knowledge to basic fabrication problems encountered by the steel and piping trades
3. demonstrate the capability to perform the basic skills of the steel and piping trades as applied to shipbuilding
4. obtain the basic trade knowledge required to effectively coordinate the activities of the various steel and piping areas.

SHIPFITTING COURSE OBJECTIVES

GRADE 10

The student will be able to:

1. read a rule or tape measure
2. interpret orthographic projections
3. do basic math
4. interpret basic blueprints
5. interpret sketches and drawings and prepare templates for layout work in shop
6. lay out, cut and assemble parts to construct foundations
7. identify structural shapes
8. identify structural materials
9. identify fabrication and assembly aids.
10. meet safety standards where required within the scope of the work being performed.

GRADE 11

The student will be able to:

1. interpret drawings used by shipfitters to lay out and fabricate material used to build foundations for ship's construction
2. assemble parts using the proper tools, assemble parts using the proper tools, assembly aids and methods
3. interpret engineering drawings
4. plan ahead and use proper procedure in assembling foundations/parts for ship's construction
5. understand the terms, definitions and abbreviations used in shipfitting
6. convert plate thickness to weight and vice versa
7. meet safety standards where required within the scope of the work being performed.

GRADE 12

The student will be to:

1. identify all tools and their use by a shipfitter
2. identify steel by color code
3. know the "lines of the ship" and how to use them properly for locating foundations and assemblies in ship's construction
4. understand weld symbols
5. understand blueprint format and numbering system
6. do all math used by a shipfitter
7. accomplish assignments in a safe manner by using the proper tools and techniques to build a quality product in the least possible time and cost
8. function as a shipfitter or construction worker in the field
9. Meet safety standards where required within the scope of the work being performed.

WELDING

GENERAL OBJECTIVES

1. To provide the students with the skills which will prepare them for entry level into the welding occupation of the steel trades.
2. To provide the students with the knowledge and information that will enable them to use the skill learned logically.
3. To provide the students with mock-up experiences which will enable them to use their cognitive and concert senses coherently.
4. To provide the students with practical safety rules in each lesson.

COURSE OBJECTIVES

GRADE 10

The student will be able to:

1. weld in all positions using the SMAW process
2. set-up and operate the Air-Carbon Arc Gouging equipment
3. set up a constant current power supply for the SMAW process.

GRADE 11

The student will be able to:

1. weld in all positions using the GMAW process
2. set up a constant voltage power supply for the GMAW process
3. fabricate mock-up assemblies.

GRADE 12

The student will be able to:

1. weld in all positions using the GTAW process
2. apply metallurgical properties of metals to job assignments
3. be capable of operating the SMAW, GMAW and the GTAW process safely and correctly
4. make visual assessments of welded structures to ASME Boiler code requirements.

BURNING

GENERAL OBJECTIVES

1. To provide the student experiences which will prepare the student for entry level into the Burning occupation of the steel trades.

2. To provide the student with the knowledge and information that will enable him/her to use the skills learned logically.

3. To provide the student with experiences which will enable him/her to practice these skills safely.

4. To provide the student with practical safety rules in each lesson.

GRINDING

GENERAL OBJECTIVES

1. To provide the students with the basic skills which will prepare them for entry level into the Grinding occupation of the steel trades.

2. To provide the students with the knowledge and information that will enable them to use the skills learned logically.

3. To provide students with the skills to grind structural materials using various types of air-grinding machines

4. To provide the students with practical safety rules in each lesson.

CURRICULUM OUTLINE INDEX

Shipfitting

I. Orientation

II. Basic Pipe and Fitting Information

III. Use of Hand and Power Tools

IV. Wire Bending (Hand)

V. Wire Bending (Machine)

VI. Reference Lines Pertinent in Marine Construction

VII. Simulated Pipe Runs (Advanced)

VIII. Marine Construction Blueprints

IX. Construct a Simulated Pipe Bank

X. Design to Scale a Pipe Bank

Welding

I. Shielded Metal Arc Welding Process (SMAW)

II. Terms and Definitions

III. Color Code

IV. Introduction to Welding Theory

V. Bead Placement

VI. Welding Metallurgy

VII. Gas Metal Arc Welding Process (GMAW)

VIII. Gas Tungsten Arc Welding (GTAW) Process

Burning

I. Oxygen-Propane Cutting Process (Oxy-Propane)

Grinding

I. Structural Grinding

COMPETENCIES

OPERATIONS

GRADE 10

I. Shop Orientation

A. Store tools and equipment
B. Clean shop and lockers
C. Check machine guards and safety equipment

II. Basic Pipe Work

A. Read fraction-decimal rule
B. Measure pipe length
C. Size pipe fittings
D. Cut/ream pipe
E. Measure C/C, E/C, E/E
F. Make pipe and fittings
G. Make offsets/fittings
H. Cut gaskets
I. Make flanges
J. Expand pipe
K. Fit consummable inserts

III. Tools and Equipment

A. Operate 1/4" drill
B. Operate 1/2" drill
C. Operate drill press
D. Operate pedestal grinder
E. Use gasket cutter
F. Use tubing bender
G. Leveling tools
H. Measurements
I. Threading tools

IV. Basic Wire Bending

A. Construct orthographic drawings
B. Construct isometric drawings
C. Make template layout
D. Make cardboard layout
E. Identify plan, view layout
F. Identify plan, elevated layout
G. Make three-view layout
H. Bend 1/4" template wire
I. Make offsets

V. Wirebending machines

A. Construct pipe drawings
B. Construct isometric drawings
C. Make template layout
D. Construct cardboard layout
E. Bend 3/8" aluminum rod
F. Use pipe vise
G. Use Parker bender
H. Level
I. Mark rod for bends
J. Protractor for degrees
K. Use carpenter's square

GRADE 11

I. Ship Orientation

A. Identify lines of the ship
B. Use declivity board
C. List shipyard terminology

II. Simulated Pipe Runs (Advanced)

A. Construct pipe runs
B. Make floor layout
C. Construct templates
D. Use 3/8" aluminum rod
E. Use pipe vises
F. Use bending machines
G. Use protractors
H. Use combination squares
I. Use leveling devices

III. Using Marine Construction Blueprints

A. Locate and identify pipe runs
B. Identify reference points
C. Identify port vs. STBD
D. Locate and identify valves
E. Locate frame number
F. Locate and identify ballast tks.
G. Identify pipe symbols
H. Identify numbering system
I. List types of plans

WELDING

GRADE 10

I. Grade 10 - SMAW

A. Overlay bead - flat
B. Horizontal fillet
C. Vertical fillet
D. Overhead fillet
E. Vertical butt with backing bar
F. Overhead butt with backing bar
G. Carbon arc gouging
H. Mock-up assemblies

II. Grade 11 - SMAW

A. Vertical butt - finish bead
B. Overhead butt - finish bead

III. Grade 11 - GMAW

A. Overlay bead - flat
B. Horizontal fillet
C. Vertical fillet
D. Overhead fillet
E. Vertical butt with backing bar
F. Overhead butt with backing bar
G. Horizontal butt - open root
H. Mock-up assemblies

IV. Grade 12 - SMAW

A. Structural qualifications

V. Grade 12 - GTAW

A. Overlay beads - flat
B. Vertical butt with backing bar
C. Overhead butt with backing bar
D. Horizontal fixed position
E. Pipe with f.b. insert
F. Vertical fixed position
G. Pipe with f.b. insert
H. Vertical fixed pipe with open root
I. Horizontal fixed pipe with open root
J. Mock-up assemblies

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BURNING

GRADE 9

I. Set Up Torch, Tip and Gas Regulators

II. Hook Up Torch, Tip and Gas Regulators

III. Leak Test Procedure

IV. Lighting and Adjusting Flame

V. Manual Burning

- A. Side to side
- B. Push and pull

VI. Angle and Tubing Cutting

VII. Circle Cutting

VIII. Beveling

- A. Single bevel
- B. Double bevel

IX. Piercing

X. Portable Cutting Machine

- A. Straight cuts
- B. Beveling

GRINDING

GRADE 9

I. Safety

II. Set Up Equipment

III. Mock-Up of Airhose and Machine

IV. Grinding Flame Cuts

V. Grinding Flame Bevels

VI. Use of Cutting Wheels

VII. Sniping Tacks

VIII. Finish Grinding

IX. Backgouged Grinding

CURRICULUM

SHIPFITTING

I. Orientation

A. What is pipefitting and its role in the shipbuilding industry?
B. History, development of piping
C. Fire and emergency alarms
D. Means of egress
E. Emergency procedures
F. Recall
G. Location and use of fire alarms
H. Location and use of fire extinguishers
I. First aid procedures
    1. report all injuries to yourself or your classmates regardless how minor
J. Shop safety rules
    1. running
    2. horseplay, throwing, etc.
    3. lifting
    4. eyes
    5. clothing
    6. hair
    7. open flames, ex. melting pots, burning torches, etc.
K. Machinery
    1. general safety
    2. machine guards
L. Electrical safety
    1. disconnect locations
    2. hazards
    3. mandatory precautions

II. Basic Pipe and Fitting Information

A. Read fraction-decimal rule
    1. how to read rule
    2. apply decimal (and fraction, addition, subtraction, and division)
B. Pipe sizes - O.D. vs. ips
C. Pipe fittings - O.D. vs. ips
    1. pipe
        a. copper-copper nickel-nickel copper-steel, etc.
    2. fittings
        a. couplings-elbows-tees, etc.
    3. valves
        a. globe-check-ball
    4. gaskets
        a. flexatallic-asbestos-rubber-o-ring

5. brazing rings
    a. grades-kinds
    b. uses
6. consummable inserts
    a. grades-kinds
    b. uses
7. fasteners
    a. bolts-national fine, course-thds, per inch
    b. nuts-hex-square-lock

III. Use of Hand and Power Tools

A. Leveling tools (safety)
    1. torpedo level
    2. plumb bob
    3. combination square
B. Marking tools (safety)
    1. scratch awl
    2. scribe
    3. etcher (electric)
C. Holding tools (safety)
    1. pliers
    2. vises
    3. wrenches
D. Toothed cutting tools (safety)
    1. files
    2. hack saws
E. Scraping and grinding tools (safety)
    1. abrasive cloth
    2. bench and pedestal grinders
F. Sharp edge cutting tools (safety)
    1. knife
    2. shears
    3. gasket cutter
    4. pipe cutter
G. Boring tools (safety)
    1. bits
    2. drills
    3. reamers
H. Threading tools (safety)
    1. dies
    2. stocks
I. Fastening tools (safety)
    1. hammers
    2. screwdrivers
    3. wrenches
J. Bending tools (safety)
    1. hickey
    2. tubing bender hand and machine
K. Measuring tools (safety)
    1. ten and twelve foot steel tape
    2. six foot folding rule
    3. protractor
    4. micrometer
    5. vernier caliper

IV. Wire Bending (by hand)

A. Orthographic drawings (block)
   1. object lines
   2. hidden lines
   3. center lines
B. Isometric drawings (block)
   1. object lines
   2. dimension lines
C. Cardboard layout
   1. using plan-elevation and section views
D. 1/4" aluminum wire
   1. layout
   2. allowances for bends
   3. degree of accuracy

V. Wire Bending (machine)

A. Orthographic pipe drawings (block)
   1. plan-elevation section views
   2. object lines
   3. scaling
      a. 3/4"=1'
      b. 1 1/2"=1'
B. Isometric pipe drawings (block)
   1. forward-aft measurements
   2. inboard-outboard measurements
   3. height measurements
   4. dimensions
C. Cardboard layout
   1. using plan-elevation and section views
D. 3/8" aluminum wire
   1. layout
   2. allowance for bends
   3. machine set up
   4. degree of accuracy

VI. Reference Lines - Marine Construction

A. Lines of the ship
   1. purpose of reference points
   2. planes - vertical - horizontal
   3. declivity:
      a. rise per foot in elevation
   4. declivity board
      a. forward to aft readings
   5. baseline
   6. water lines
   7. true main axis
   8. vertical center line
   9. buttock lines
   10. frame and frame lines

VII. Simulated Pipe Runs (Advanced)

A. Orthographic pie runs
   1. three dimensional
   2. to scale
B. Bending machine
   1. use of levels
   2. use of protractors
   3. 3/8" aluminum rod

VIII. Marine Construction Blueprints

A. Blueprint format
   1. title block
   2. general notes
   3. list of material
      a. pipes-fittings-valves-etc.
   4. body
      a. main views-plan-elevation-section
   5. revision block
   6. reference block
   7. zoning
B. Types of plans
   1. material lists
      a. gives description of materials required
   2. working plan
      a. show location of pipe and fittings
      b. gives requirements for correct installation
   3. details
      a. series of short pipe runs often fabricated in shop
   4. joint "identification"
      a. gives pictorial display
      b. indicates type of fit-up
   5. welding braze index
      a. indicates weld procedure
      b. indicates type of nondestructive test
   6. Diagram
      a. illustrates continuity of system

IX. Construct a Simulated Pipe Bank

A. Construction procedure
   1. determine penetration locations
      a. work within parameters of bulkhead penetration plan
   2. Install penetrations on bulkhead
      a. connect poly disk to plywood
   3. install pipe hanger
   4. install simulated pipe runs
      a. connect from bulkhead to bank hanger

X. Design to Scale a Pipe Bank

A. Use of three views

WELDING

I. Shielded Metal Arc Welding Process (SMAW)

- A. Safety
  - 1. personal
  - 2. equipment
  - 3. set up
- B. SMAW Process
  - 1. definition
  - 2. elements of the arc welding circuit
    - a. electrode
    - b. electrode holder
    - c. arc
    - d. welding power supply
  - 3. function of the electrode covering
  - 4. electrode classification system
  - 5. electrode diameters and weights
  - 6. arc welding problems and remedies
  - 7. four points of welding
    - a. angle of electrode
    - b. current setting
    - c. speed of travel
    - d. arc length
- C. Power sources
  - 1. constant current
  - 2. types of current
    - a. AC - alternating current
    - b. DC - direct current
  - 3. polarities
    - a. DCRP
    - b. DCSP
- D. Introduction to arc and electricity
  - 1. amperes
  - 2. OHMS
  - 3. volts
  - 4. parts of the arc
  - 5. current flow
  - 6. welding polarity
  - 7. DC fundamentals
  - 8. the welding circuit
  - 9. AC fundamentals
  - 10. wave shapes - AC and DC
- E. Arc physic
  - 1. cathode - cathode drop repair
  - 2. anode - anode drop region
  - 3. arc column - plasma

II. Terms and Definitions

III. Color Code
- A. Materials - Base
  - 1. Hy-80 - brown
  - 2. CMN - yellow
  - 3. HTS - green

IV. Introduction to Welding Theory

- A. What is a weld?
- B. Criteria for a weld
  1. cleanliness
  2. atomic closeness
- C. Examination of a weld cross-section
  1. weld metal
  2. fusion line
  3. heat affected zone (HAZ)
     a. grain - coarsen region
     b. grain - refined region
     c. transition region
- D. Types of discontinuities
  1. porosity
  2. cracks
  3. lack of fusion
  4. slag
  5. undercut
  6. overlap
- E. Causes of discontinuities
- F. Preheat and interpass temperatures
- G. Heat input requirements
- H. Joint designs
- I. Technique sheets
- J. Distortion of welding processes
- K. Control of distortion
- L. Selection of welding process to type of base material

V. Bead Placement

- A. Standard bead placement
- B. Temper bead placement
- C. Repair welds
- D. Proper pickup and starts

VI. Welding Metallurgy

- A. Mechanical properties
  1. tensile strength
  2. yield strength
  3. elongations
  4. hardness
  5. ductility
  6. impact strength
  7. toughness and malleability
  8. stress - strain diagram
  9. thermal expansion and conductivity
- B. Structures of metals
  1. space lattices
     a. BCC - body centered cubic
     b. FCC - face centered cubic
     c. HCP - hexagonal closed packed

2. crystallization of metals
3. heat effect on grain structure
4. cooling effect on grain structure
5. importance of carbon in metals
6. family of steels
7. phase transformations of steels
    a. austenite
    b. pearlite
    c. mastensite

C. Types of steels
1. low-carbon
2. medium-carbon
3. high-carbon
4. low alloy steels
5. high alloy steels

D. Nonferrous metals
1. light metals
    a. aluminum
    b. copper
2. heavy metals
    a. NICU - nickel-copper (70-30)
    b. CUNI - Copper-Nickel (70-30)

c. Inconel

VII. Gas Metal Arc Welding Process (GMAW)

A. Safety
1. personal
2. equipment
3. set-up

B. GMAW process
1. definition
2. elements of the GMAW system
    a. power supply
    b. electrode cable
    c. torch with continuously feed electrode
    d. ARC
    e. workpiece
    f. ground cable
    g. gas supply
    h. water supply
3. pictorial diagram of GMAW process
4. advantages of the GMAW process
5. disadvantages of the GMAW process
6. modes of metal transfer
    a. globular transfer
    b. short circuit transfer
    c. spray arc transfer
    d. pulse arc transfer

C. Operating characteristics
   1. wire feed speed and welding current
   2. wire diameter and current densities
   3. volt-ampere responses
   4. transition current
   5. rising - drooping - constant voltage
   6. change in current contact-to-work distance
   7. arc length changes

D. Shielding Gases
   1. Argon
   2. Argon 75% - Co_2 25% (75-25)
   3. Argon 95% - Co_2 5% (95-5)
   4. Argon 99% - Oxygen 1% and Oxygen 2% (M-1, M-2)
   5. Helium

E. Discontinuities in the GMAW Process
   1. cold cap
   2. surface porosity
   3. crater cracks
   4. insufficient penetration
   5. excessive penetration
   6. whiskers

F. Types of electrodes
   1. carbon steel; 70S-2, 70S-3
   2. low alloy steel; 100S-1, 100S-2, AX-90
   3. nickel, copper, RN-60
   4. copper, nickel, RN-67
   5. inconel, RN-82
   6. flux core
   7. aluminum 5655

G. Power supplies
   1. constant voltage - fixed slope
   2. constant voltage - variable slope
   3. constant current - fixed slope
   4. constant current - variable slope
   5. slope
   6. inductance
   7. voltage

VIII. Gas Tungsten Arc Welding (GTAW) Process

A. Safety
   1. personal
   2. equipment
   3. set-up

B. Definition of GTAW

C. Elements of the GTAW system
   1. power supply
   2. electrode cable
   3. welding torch and electrode
   4. arc
   5. workpiece
   6. gas and water supply
   7. ground cable

D. Pictorial diagram of GTAW system

E. Advantages of the GTAW process
    1. high quality for critical weldments
    2. versatility for welding most metals
    3. nonconsummable electrode allows for good control of deposition rate
    4. all position welding
    5. adapted for thin metals
F. Disadvantages of the GTAW process
    1. low deposition rates
    2. high level of welder skill required
G. Major component - variables of the GTAW process
    1. electrical component variables
        a. variable current
            1. DCSP
            2. DCRP
            3. AC
        b. power supplies
            1. transformers - AC
            2. transformer/rectifier - AC, DCSP, DCRP
            3. motor generators - AC, DCSP, DCRP
        c. electrodes
            1. pure Tungsten
            2. Tungsten with Thorium
            3. Tungsten with Zirconium
H. Shielding gas
    1. Argon - AR
    2. Helium - HE
    3. Argon-Helium - AR-HE

BURNING

I. Oxygen-Propane Cutting Process (Oxy-Propane)

- A. Safety
  - 1. set up
  - 2. equipment
  - 3. leak-test
- B. Oxy-propane cutting process
  - 1. definition
  - 2. elements of the cutting process
    - a. torch
    - b. tips
    - c. hoses
    - d. oxygen and fuel gas regulators
    - e. striker
    - f. five-way wrench
    - g. oxygen supply
    - h. fuel gas supply
    - i. check valves
- C. Function of the fuel gas and oxygen gas
- D. Types of torches (Harris Universal)
  - 1. standard hand-held torch (70°, 90°, 180° Head)
  - 2. short barreled torch
  - 3. circular torch
  - 4. offset head torch
  - 5. extra long barreled torch
  - 6. long machine torch
  - 7. short machine torch
- E. Torch tips
  - 1. NX - hand cutting
  - 2. VVC - machine cutting
  - 3. NFFR - washing
  - 4. GG - gouging
- F. Burning terminology
- G. Hook-up and leak-test procedure
- H. Adjusting the flame
  - 1. carburizing
  - 2. neutral
  - 3. oxidizing
  - 4. neutral flame with cutting oxygen
- I. Burner's responsibility
  - 1. support shipfitters
  - 2. support welders
  - 3. support pipefitters
- J. General burning techniques
  - 1. side to side
  - 2. push and pull
  - 3. piercing
  - 4. washing and gouging

K. Oxygen and fuel gas regulators
    1. manifold type
        a. single stage
        b. two stage
    2. cylinder type
        a. single stage
        b. two stage
L. Burner's safety equipment
    1. welder's goggles
    2. safety glasses
    3. leather jacket - apron
    4. leather gloves
    5. hard hat
    6. face shield
    7. safety shoes
    8. respiratory
M. How the burning process works
N. Materials that can be cut
    1. CMN
    2. HT
    3. HY-80
    4. cast-iron
O. Portable cutting machine
    1. Bug-O
    2. Hobo
    3. Kat
P. Correcting faults
    1. dirty tips
    2. too much oxygen
    3. too much preheat
    4. extremely fast travel
    5. extremely slow travel
    6. slightly fast travel
    7. slightly slow travel
    8. tip too high
    9. tip too low
Q. Insulating material
    1. Refrasil
    2. Locan
R. Plasma arc cutting process
    1. definition
    2. equipment
    3. uses

GRINDING

I. Structural Grinding

A. Safety
   1. set up
   2. equipment
   3. personal

B. Grinding equipment
   1. safety glasses
   2. ear protection
   3. shield
   4. work gloves
   5. safety shoes
   6. hard hat
   7. protractor
   8. depth gage

C. Grinding terms and definitions

D. Responsibilities of grinders
   1. service welders
   2. service shipfitters
   3. service pipefitters
   4. service other hull trades

E. Types of grinders
   1. Chicago Whirly Bird - 6,000 RPM
   2. straight abrasive wheel

F. Carbide burrs
   1. blunt-round burr
   2. cone-shape burr
   3. long shaft burr
   4. short shaft burr

G. Mounting instruction
   1. grinding wheel mount
   2. cut-off-wheel mount

H. Hook-up of airhose and machine
   1. manifold
   2. leader hose
   3. quick-disconnect

I. Safe operating procedure
   1. speed of wheel vs. speed of machine
   2. safety guard
   3. cover-up
   4. starting machine
   5. ring test

J. Grinding techniques
   1. flame cuts
   2. grinding bevels
   3. back grinding
   4. sniping tacks
   5. finish grinding

K. Cutting wheel techniques
   1. sniping tacks
   2. cutting angle
   3. cutting square tubing
   4. cutting sheet steel

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"Welding: Principles and Practices", Raymond Sacks, 1981

"The Burner's Handbook", Electric Boat Division, General Dynamics, 1977

The Shipfitters Handbook, 1977

The Pipefitters Handbook, 1977

The Welders Handbook, 1977

The Burner/Grinder Handbook, 1977

Interpreting Engineering Drawings, 1972

Basic Blueprint Reading and Sketching, 1972

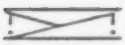
STUDENT PROGRESS RECORD

A major principle of vocational education is that students learn skills or the performance of operations of a trade with the production job as a vehicle to accomplish this objective.

The operations are defined on the shop progress record and it is imperative that the instructor have some means of recording the student experiences and achievement.

The approved method of recording student progress is as follows:

INSTRUCTED - This designation on the progress record indicates that the student has performed a skill with the assistance of and under the supervision of the instructor.



PRACTICED - This designation on the progress record indicates that the student has performed a skill with little help from the instructor.

PROFICIENT - This designation on the progress record indicates that the student is capable of performing a skill within a reasonable amount of time with no assistance from the instructor. In effect, this implies that the student has been tested for that skill.

This method of noting student progress will define accurately student achievement and, in fact, will point out any weaknesses the student may have in certain operations, thus highlighting areas where the student may need help.

Grades should be kept on student daily progress cards or in roll books.

Grade_____ Year_____ Instructor_____

STUDENT	TOOL CHECK NO.	LOCKER NO.	TEXT BOOK NO.	SHOP GRADES MARKING PERIOD						THEORY GRADES MARKING PERIOD					
				1	2	3	4		F	1	2	3	4		F

Grade_____ Year_____ Instructor_____

TOOL CHECK NO.	LOCKER NO.	TEXT BOOK NO.	SHOP GRADES MARKING PERIOD						THEORY GRADES MARKING PERIOD					
			1	2	3	4		F	1	2	3	4		F

Grade_____ Year_____ Instructor_____

TOOL CHECK NO.	LOCKER NO.	TEXT BOOK NO.	SHOP GRADES MARKING PERIOD						THEORY GRADES MARKING PERIOD					
			1	2	3	4		F	1	2	3	4		F

Grade_____ Year_____ Instructor_____

TOOL CHECK NO.	LOCKER NO.	TEXT BOOK NO.	SHOP GRADES MARKING PERIOD						THEORY GRADES MARKING PERIOD					
			1	2	3	4		F	1	2	3	4		F

Grade_____ Year_____ Instructor_____

TOOL CHECK NO.	LOCKER NO.	TEXT BOOK NO.	SHOP GRADES MARKING PERIOD						THEORY GRADES MARKING PERIOD					
			1	2	3	4		F	1	2	3	4		F

Shop Orientation

Basic Pipe Work

	Store tools and equipment	Clean shop and lockers	Clean machine guards and safety equipment			Read fraction-decimal rule	Measure pipe length	Size pipe fittings	Cut/ream pipe	Measure C/C, E/C, E/E	Make pipe and fittings	Make offsets/fittings	Cut gaskets	Make flanges

Basic
Pipe Work

Tools and Equipment

Expand pipe	Fit consummable inserts			Operate 1/4" drill	Operate 1/2" drill	Operate drill press	Operate pedestal grinder	Use gasket cutter	Use tubing bender	Leveling tools	Measurements	Threading tools	

Basic Wire Bending

Wirebending Machines

Construct orthographic drawing	Construct isometric drawing	Make template layout	Make cardboard layout	Identify plan, view layout	Identify plan, elevated layout	Make three-view layout	Bend 1/4" template wire	Make offsets			Construct pipe drawings	Construct isometric drawings	Make template layout		

Wirebending Machines

Ship Orientation

	Construct cardboard layout	Bend 3/8" aluminum rod	Use pipe vise	Use Parker bender	Level	Mark rod for bends	Protractor for degrees	Use carpenter's square			Identify lines of the ship	Use declivity board	List shipyard terminology	

Simulated Pipe Runs

Using Marine Construction Blueprints

Construct pipe runs	Make floor layout	Construct templates	Use 3/8" aluminum rod	Use pipe vises	Use bending machines	Use protractors	Use combination squares	Use leveling devices			Locate and identify pipe runs	Identify reference points	Identify port vs. STBD

Using Marine
Construction Blueprints

	Locate and identify valves	Locate frame number	Locate and identify ballast tks.	Identify pipe symbols	Identify numbering system	List types of plans								

Grade 10-SMAW

Grade 11-SMAW

Overlay bead - flat	Horizontal fillet	Vertical fillet	Overhead fillet	Vertical butt with backing bar	Overhead butt with backing bar	Carbon arc gouging	Mock-up assemblies				Vertical butt - finish bead	Overhead butt - finish bead	

Grade 11-GMAW

Grade 12-SMAW

| Overlay bead - flat | | |

Grade 12-GTAW

Overlay beads - flat	Vertical butt with backing bar	Overhead butt with backing bar	Horizontal fixed position	Pipe with f.b. insert	Vertical fixed position	Pipe with f.b. insert	Vertical fixed pipe with open root	Horizontal fixed pipe with open root	Mock-up assemblies				

Burning--Grade 9

	Set up torch, tip and gas regulators	Hook up torch, tip and gas regulators	Leak test procedure	Lighting & Adjusting Flame	Manual burning	slide to side	push and pull	Angle and Tubing Cutting	Circle cutting	Beveling	single bevel	double bevel	Piercing	Portable cutting machine

GRINDING--Grade 9

Safety	Set up equipment	Mock-up of airhose and machine	Grinding flame cuts	Grinding flame bevels	Use of cutting wheels	Snipping tacks	Finish grinding	Backgouged grinding					